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Impact of COVID-19 on Educational Sustainability. Initial Perceptions of the University Community of the University of Cádiz

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Abstract: This research analyses the impact of COVID-19 on the Spanish university system during the period of home lockdown put in place by the government of Spain between 15 March and 21 June 2020. This period did not involve a change to online teaching. Instead, it involved emergency remote teaching, wherein the content of face-to-face teaching was taught through non-classroom training using media, devices and tools available at that time. The main objective of the paper is related to the perceptions of students and teachers on emergency remote teaching regarding the face-to-face model. We applied statistical techniques of descriptive and inferential analysis over a sample of 2778 students and 221 teaching staff from the University of Cádiz. We also analysed the methodologies used, as well as the acquisition of skills, competencies and knowledge by the students in this situation, in order to detect whether this type of action can achieve sustainable education. This term refers to education that is capable of maintaining the continuous quality of the training of each student, who should acquire the required knowledge and competences regardless of unforeseen events. However, according to the results of this research, the sudden transition to e-learning, based on available technological and computer-based methods, did not guarantee sustainable education or its quality. This study establishes different possibilities for improving non-face-to-face teaching in this kind of situation. The results show greatly concerning levels of training and evaluation, as well as worse acquisition of skills. Both teachers and students declared a preference for face-to-face teaching. This perception should prompt the educational authorities to solve the existing problems in e-learning education, improving the transition and guaranteeing the sustainability of non-face-to-face education. This research highlights the areas for improvement in e-learning education in the ongoing situation, the general uncertainty in the transition, the lack of communication and the completion of a fair evaluation system. The results show that the methods used in this period must be improved to achieve sustainable teaching and learning during a pandemic. The results also emphasize the uncertainty in the educational community about the entire process. This study will help the educational authorities to improve the change of paradigm in higher education in the future.

Keywords: teaching quality; higher education; virtual classes; virtual environments; virtual universities; skills and knowledge

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1. Introduction

Currently, we are immersed in a global pandemic caused by the illness known as COVID-19. This illness is caused by coronavirus 2 (SARS-CoV-2), which generates, among other symptoms, a severe acute respiratory syndrome [1].

Epidemiologic investigations located the origin of this virus to be Wuhan's local seafood market (China), where, on 12 December 2019, the first patient was diagnosed [2–4].

The World Health Organization declared a pandemic, caused by COVID-19, on 11 March 2020. So far, this pandemic has resulted in more than 37 million confirmed cases and over one million deaths globally, affecting over 200 countries [5]. The numbers continue to increase and the pandemic remains an ongoing global issue due to second waves of infections and viral rebounds in countries that initially had control of the illness.

The fast rate at which the virus can spread, as observed between March and May of 2020, forced governments from different affected countries to take significant and extraordinary measures to contain it. Cultural, logistical and economic pillars were affected locally and globally by these initiatives. Specifically, the education sector has been affected by both the illness and the measures taken by governments, resulting in a face-to-face educational model being unsustainable during this period. For instance, most governments temporally closed all educational institutions. During April 2020, this measure affected approximately 90% of the global population of students [6]. Since the virus's origin, and during the expansion period, the closures of different levels of education centres was gradual and progressive, as seen in Figure 1. Overall, UNESCO estimates that the maximum number of students who had not been able to receive on-site education is near of 1,600,000. These data include 189 countries, with the worst performers in April 2020, exceeding 90% of all students. The affected students belong to levels 0 to 3 and 5 to 8 of the International Standard Classification of Education, or ISCED [7]. The United Nations Educational Scientific and Cultural Organization (UNESCO) also found that most of the lockdowns were implemented at a national level throughout each country. While some lockdowns were partially performed, only being implemented in certain zones of each territory, they generally evolved to a complete lockdown.

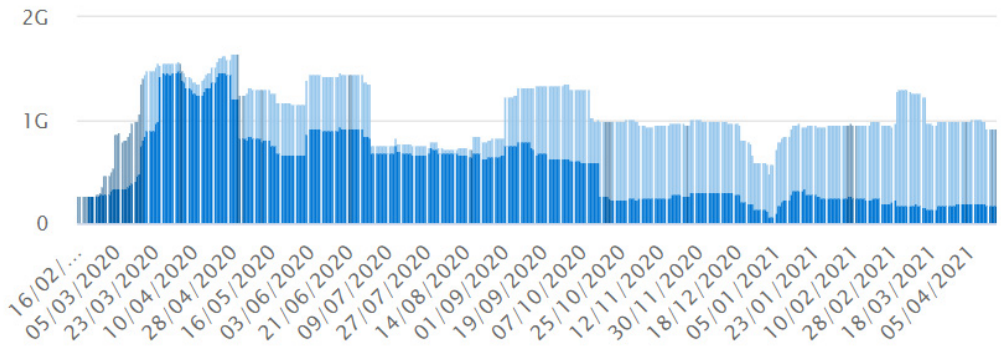

Figure 1. Evolution of affected students by centres closures between 16 February 2020 and 16 April 2021. Source: Adapted from UNESCO Institute for Statistics.

Figure 1 represents affected students by total (represented in dark blue) and partial (represented in light blue) closures from February 2020 to date. It can be seen that, until the end of April 2020, the trend was towards total closure of the centres in the affected countries. Since then, at a very slow rate, the opposite has occurred, with centres resorting to local or partial closures.

Although this global crisis is singular and extraordinary, in 2009, Japan suffered from the H1N1 pandemic [8]. After that crisis, many investigators claimed that the closure of schools and education environments might be an effective measure for preventing epidemics from spreading [9–12]. These studies established simulations and experiments which concluded that is possible to prevent the transmission between children and young people and, as an extension, the rest of the community; this data could justify the previously mentioned closure of centres. In this regard, Figure 1 shows that school closures remain a widely used tool worldwide to control pandemics. According to UNESCO, 10% of students were still affected by these closures in April 2021 [6]. This means that closures do not occur because of the school seasons, but because of increased incidence of the virus. For this reason, it is important to have educational strategies that allow for easy adaptation for both

students and teachers, ensuring sustainable and continuous development of learning and teaching, respectively.

More specifically, the pandemic has caused a major impact on university education and the community, both for teachers and students, as well as for the rest of the administration workers [13]. Their closures have led to cancellations and delays in national and international residences [14], both for students and teachers, and administrative services are responsible for their management [15]. In addition, after the closure of educational centres, and after the transformation, in most countries, of face-to-face classes to non-face-to-face classes, teachers and students had to adapt to an e-learning system. E-learning describes a mode of learning and teaching through technology and the internet [16,17]. The main feature of e-learning is that both students and teachers will be able to access content at any time of the day and all over the world. However, communication is known to be worse than in face-to-face education, so it is important to highlight the tools available to connect students and teachers: e-mail, chat, videoconferencing, etc.

The adaptation to this new method has made students and teachers wonder if we were really prepared for this method, sometimes feeling the impediment of carrying out certain activities. Especially those related to laboratory practices [18]. The method used in most universities consisted of emergency remote teaching (ERT), instead of conventional online teaching. Thus, the contents of face-to-face teaching were delivered in distance learning using the means, devices and tools available at the time. It is important to distinguish between the normal, everyday type of effective online teaching and that which we carry out in a hurry with minimum resources and scarce time [19].

Traditionally and outside this emergency adaptation, there are no significant differences in the adaptation of theoretical or laboratory classes between e-teaching and face-to-face teaching. In [20], the differences between theoretical and practical classes were analysed, not only in terms of student satisfaction levels and academic performance. The study evaluated the different aspects and tools, looking for the strengths and weaknesses of practical and theoretical activities under both modes of teaching with hardly any differences, so it can be assumed that the possibilities of adaptation to practical and theoretical activities are not necessarily different in a quality non-face-to-face training.

In this regard, some research has established that higher education institutions were not prepared for e-learning online [21], pointing to the need to improve sustainable digital development in higher education [22,23]. In addition, students perceive Internet connectivity, poor interaction and lower motivation, participation and understanding of content as the biggest problems [24].

However, from this experience, not everything has been disadvantageous. Some advantages of non-face-to-face education have been perceived [25], which is not a new concept. Different researches have found in e-learning a new way to enhance the learning process, where social media can further improve the learning outcome [26]. These researches highlight its flexibility, while keeping as the main stumbling block the need for adequate electronic devices and Internet connection [27,28].

Specifically, it is important to ensure that students find e-learning easy to access, convenient and easy to be reviewed for exams [24].

It has already been noted that all European universities closed their centres during March 2020 [28]. Although some of them reopened in April and May (Table 1), most of them did not open. They not only provided e-learning training, as mentioned above, but also online evaluations. These universities, including those in Spain, only opened between June and July exclusively for the work of teaching and research staff, not for student teaching and assessment.

Spain is one of the countries that has closed the door to face-to-face classes at university for the entire academic year 2019 to 2020, including the development of online student evaluation. According to data published by the Ministry of Science, Innovation and Universities, this situation affected 1,289,233 undergraduate students (ISCED levels 5 and 6) and 205,049 Master's students. Of these 1,494,282 students, only 15% have opted for an

online system—14.6% of ISCED levels 5 and 6 students and 23% of level 7 students [29]. This means that Spain does not have a tradition of teaching and learning in a non-face-to-face model, and raises the question of whether the methodologies and tools used have been correctly selected to ensure quality and sustainable education.

Table 1. Universities' reopening by European countries during the academic year 2019 to 2020 (European Commission, 2020).

Country	University's Reopening
Germany, Latvia, Norway, Poland, Cyprus	April
Bulgaria, Denmark, Estonia, Italy, Cyprus, Lithuania, Holland, Romania, Finland, Switzerland, Iceland, Liechtenstein, Turkey	May
Czech Republic, Ireland, Spain, France, Croatia, Luxembourg, Hungary, Republic of Malta, Austria, Portugal, Slovenia, Slovakia, Sweden, United Kingdom, Albania, Bosnia and Herzegovina, Montenegro, North Macedonia	Without reopening academic year 2019 to 2020

Moreover, the pandemic has provoked a high level of uncertainty, even with the so-called "new normal", which has had an effect not only socially and economically but also educationally. Specifically, in Spain, governments and autonomous communities decreed that, during the 2019 to 2020 academic year, not only would universities not return to classrooms but neither would any of the other level of Spanish education [30]. It has been acknowledged that it is not known when face-to-face classes will be resumed, with most of the universities' academic activities for the 2020 to 2021 academic year being established as online. In the case of face-to-face activities (which have been significantly reduced), they are always subject to modifications to adapt them to an online methodology if necessary [31]. This generates great concern among university communities, not only about the educational methodology, but also about the evaluation system that will be used. On 23 April 2020, the Minister of Universities, Manuel Castells, highlighted the possibility that this new reality, which is of global concern, would lead to an adaptation of the face-to-face education system to a blended system between face-to-face and distance learning [32], which would not only be applied during the pandemic but also afterwards. This blended system is known as b-learning [33]. The main characteristic of b-learning is that it takes advantage of the direct contact with the teacher during face-to-face classes to promote learning and motivate students, but at the same time develops students' capacity for self-organization and autonomous learning.

Currently, as in the past, there is a possibility of virus outbreaks, and although face-to-face classes could be resumed for some academic activities, this could lead to the same situation as in March 2020.

For this reason, together with the high level of uncertainty that Spain and other countries are experiencing in this new situation, the present research contributes to providing a first insight into the level of acceptance that e-learning classes have received in a specific Spanish university. It analyses the real situation at a specific moment in the evolution of the pandemic in Spain, with the country confined and barely a month since the transition process between both methods began. This research shows the successes and failures of the transition, giving the option to establish future lines of research and indicators that promote quality education, whether e-learning or b-learning.

This work introduces an analysis of the situation experienced at the particular level of the University of Cádiz, but with results that can be extrapolated to Spanish Higher Education. Similar situations may be repeated in future courses with a high probability, so the results obtained in this study on the adaptations and concerns of students and university teachers will be of interest and as an aid for the future development of e-learning or b-learning education—perhaps even the choice of these methods over traditional face-to-face education.

In this regard, in accordance with the main objective—students' and teachers' perceptions of emergency remote teaching with respect to the face-to-face model—we have studied this perception on three different levels. The first level is related to the perception of the tools for the adaptation to the emergency remote teaching. The second concerns the skills and time of dedication. The last is about the evaluation system and satisfaction with the measures taken.

2. Materials and Methods

For the development of this research, it was necessary to consult teachers and students at the University of Cádiz (UCA). Data collection was carried out between 13 April and 20 April 2020. Google Forms was used to ask users questions anonymously, when Spanish Universities were closed since 15 March [21] and there was no knowledge about the evaluation methods that were going to be implemented. There was no knowledge even if the modality of those would be onsite or online, so the uncertainty of all those surveyed was high.

For the development of the consultation tool, two surveys were used for each of the aforementioned groups. These surveys, with similar questions, were disseminated by email and social networks, with the aim of analysing the opinion expressed by both students and the teaching team on the different aspects of non-face-to-face teaching. This analysis is carried out both individually, group by group, and jointly, making a comparison between the opinion of teachers and students.

The methodology used combines qualitative and quantitative aspects with a descriptive and exploratory purpose. The design of these surveys was based on a previous review of the literature [34–36] and on the measures adopted in educational settings during the current pandemic situation. Special consideration has been given to the measures taken and proposed by the UCA, as this is the university where the case study was carried out.

In other studies, such as [37–41], it appears that the main disadvantages of e-learning are a lack of motivation or evaluation problems, among others, and the main advantages are, in general, convenient revision of material and easy access. This article aims to contrast these first results with the extraordinary situation that has led universities to adapt to e-learning in a short period of time.

The natures of the questions in these surveys, in turn, belong to three large blocks according to their relationship to (1) the availability of tools for adapting to online teaching; (2) the opinion on the teaching given and received, the dedication of the same and the differences it presents with respect to face-to-face teaching; and (3) the concern regarding the evaluation of this teaching given as well as the level of satisfaction with the measures adopted and the new educational system.

In the specific case of block 2, the competences, skills and knowledge demanded by the working environment have been considered [25], in order to establish possible differences between their acquisition in the different learning modalities, which may suppose some kind of benefit or disadvantage for the incorporation of university students into the labour market, once they have completed their studies. Similarly, the level of communication between students, and between students and teachers, is analysed to compare face-to-face and online education systems in this area. Once the consultation has been developed and the data obtained, an evaluation is made of the current state of non-face-to-face education as an isolation measure imposed by the pandemic.

The nature of the variables used, the techniques employed for the statistical analysis of the data and the description of the study population compared to the sample obtained are presented below.

2.1. Nature of the Variables Used

The variables analysed in this study have been differentiated into several sections according to the study blocks and the responses to both levels (teachers and students)

have been analysed. The survey questions and the nature of the variables to be considered (quantitative, qualitative, or dichotomous) are included below.

Firstly, in relation to the analysis of the respondent, we have worked with the variables sex (dichotomous), age (quantitative), studies or professional category (qualitative) and area of knowledge (qualitative).

For the analysis of the availability of tools for adaptation to non-face-to-face teaching (block 1), we asked about the material available for adapting to e-learning, focusing on the quality of the Internet connection (quantitative), the type of device (qualitative), whether or not they share the device (dichotomous), whether they have had to purchase a new device (dichotomous) and the amount of expense (quantitative).

For block 2, information was collected on preparation time before and after the transition to non-face-to-face teaching, coding the variable to obtain the hours per week in both classes (quantitative). In order to assess the usefulness of the materials available (notes, bibliography, videos, classrooms, among others), a series of quantitative variables were considered. In relation to the study of the acquisition of skills included in Accenture [24], these skills were conditioned to a qualitative response and then coded as quantitative in the statistical analysis. Continuing in this block, in the section on the assessment of method and difficulty, quantitative and qualitative variables were used, as well as the perception of the classes (qualitative) and the assessment of a future for virtual subjects (dichotomous).

Finally, in the evaluation section and the level of satisfaction with respect to the measures adopted and the new educational system (block 3), the evaluation concern (quantitative), the definition and guarantees of said evaluation (dichotomous variables) were analysed to assess the adequacy of the system (quantitative) and whether the respondent considers it easy to pass the subject with this new non-face-to-face model (dichotomous).

For the teaching centre, we also asked whether they were prepared to make a transition to online teaching (quantitative) and whether they see the need for training support for adaptation (dichotomous).

2.2. Study Techniques Used

For the statistical analysis of these data, descriptive statistical techniques of univariate and inferential analysis were used. In the case of qualitative variables, frequency analysis, subgroup analysis and the study of percentile were considered. In relation to the quantitative variables, the basic statistics of central tendency and quantiles were obtained. The inferential statistical studies focused on parametric contrasts of proportions and non-parametric contrasts of medians (Mann–Whitney contrast for two populations and the generalised Kruskal–Wallis test) and normality of distributions (Kolmogorov–Smirnov).

2.3. Description of the Population

The study population is made up of the students and teaching staff of the UCA. This University is located in the southwest of Andalusia, and in the southernmost part of the Spanish peninsular territories. It currently has 17,743 undergraduate students and 2350 Master's degrees students, distributed, as shown in Table 2, across four campuses: Algeciras, Cádiz, Jerez de la Frontera and Puerto Real. The different degrees are distributed on these campuses without any relation to the fields of knowledge established by the European Higher Education Area (EHEA).

The Algeciras campus covers different areas of knowledge. In its Higher Polytechnic School of Algeciras, 11 degrees are studied involving both the branches of Engineering and Social and Legal Sciences.

Socio-humanistic and health studies are carried out on the Cádiz campus. It has five centres offering 14 undergraduate degrees, in the fields of Humanities, Social and Legal Sciences, and Health Sciences.

The Jerez de la Frontera campus is mainly dedicated to Social and Legal Sciences, although it also has a classroom for nursing studies. Its two centres, together with its three permanent sites in other UCA centres—the Faculty of Economic and Business Sciences, the

Faculty of Labour Sciences and the Faculty of Nursing—offer nine undergraduate degrees from the areas of social, legal and health sciences.

Table 2. Distribution of students, centres, degrees, Master's, and branches of knowledge by university campus at the University of Cádiz with a total of 20,743 students, 1930 professors, 56 degrees and 54 Master's (academic year 2019/2020).

Campus	ALGECIRAS	CÁDIZ	JEREZ	PUERTO REAL
Students	1437	4547	7308	7451
Teachers	93	675	270	892
Centres	• Higher Polytechnic School of Algeciras	• Faculty of Economics and Business Studies • Faculty of Work Science • Faculty of Nursing and Physiotherapy • Faculty of Philosophy and Literature • Faculty of Medicine	• Faculty of Law • Faculty of Social Sciences and Communication	• School of Naval and Oceanic Engineering • School of Marine, Nautical and Radioelectronic Engineering • Higher College of Engineering • Faculty of Sciences • Faculty of Educational Sciences • Faculty of Marine and Environmental Sciences
Degrees	11	14	9	22
Master's degrees	5	17	6	26
Scope of knowledge (EHEA)	• Engineering and Architecture • Social Science	• Humanidades • Social Science • Health Science	• Social and legal Science • Health Science	• Engineering and Architecture • Social and legal Science

The Puerto Real campus has the highest concentration of science and technology-centres. It is made up of six university centres that offer 22 undergraduate degrees in the fields of knowledge of sciences, social and legal sciences and engineering and architecture.

For the development of this study, a sample of the population described above was 2999 people, of which 2778 were students, both undergraduate and Master's degrees, and 221 teachers, which represents 15.30% of the entire university community—in the specific case of students, 15.70%, and in the case of teachers, 11.50% (Table 3).

The students surveyed range from a minimum of 18 and a maximum of 66 years, with a mean age of 22.34 with a standard deviation of 5.12. The teachers consulted are between 24 and 67 years old, with a mean age of 45.84.

On the other hand, as shown in Table 3, of the data collected for students, almost 61% correspond to responses from women and 39% to men. In addition, the information obtained includes all five areas of knowledge, with social and legal sciences being the most participative. An important gender bias is observed in that there are more women than men studying in the areas of social and legal sciences and health sciences, while there are more men than women studying degrees related to engineering and architecture. The study of these biases is developed in [42,43].

Regarding the teaching team, it is observed that the response volume of the female and male sex was equal, both around 50%. Again, the area of social and legal sciences was the most participatory. However, the bias by sex and area of knowledge is more pronounced than in the case of students. It is enough to observe that for engineering and architecture studies, 77.36% of the responses are from men and only 22.64% from women. The data seem to corroborate the conclusions expressed in [44], where university teachers focus on certain branches of knowledge, showing that the university culture itself has gender biases and codes, which apply discrimination mechanisms towards female teachers.

Table 3. Distribution of the sample by area of knowledge.

	Arts and Humanities	Science	Social and Legal Science	Health Science	Engineering and Architecture	Total Per Row
Female Students	211	293	714	264	207	1689
	7.60%	10.55%	25.70%	9.50%	7.45%	60.80%
Male Students	87	150	271	79	502	1089
	3.13%	5.40%	9.76%	2.84%	18.07%	39.20%
Total Students	298	443	985	343	709	2778
	10.73%	15.95%	35.46%	12.35%	25.52%	100.00%
Female Teachers	23	26	40	8	12	109
	10.41%	11.76%	18.10%	3.62%	5.43%	49.32%
Male Teachers	12	23	27	9	41	112
	5.43%	10.41%	12.22%	4.07%	18.55%	50.68%
Total Teachers	35	49	67	17	53	221
	15.84%	22.17%	30.32%	7.69%	23.98%	100.00%

On the other hand, and as expected due to the volume of students, almost 93% of the answers obtained correspond to undergraduate students and approximately 7% to Master's students. This information is collected in Table 4.

Table 4. Students consulted by gender, level of education and age.

	Degrees	Master's Degrees	Total Per Row
Female	1564	125	1699
	56.30%	4.50%	60.80%
Male	1015	74	1089
	36.54%	2.66%	39.20%
Total per column	2579	199	2778
	92.84%	7.16%	100.00%

In the specific case of teachers, Table 5 shows the data on teachers corresponding to their professional category and gender. It is observed that the professional categories include a similar number of men and women. The exception is found in University Professors for whom the responses of the male sex double the female.

Table 5. Distribution of university teachers surveyed by Spanish professional category system and gender. CU (catedrático Universitario—university professor), TU (titular universitario—university professor), CD (contratado doctor—contracted doctor), AD (ayudante docto—doctor assistant), CEU (catedrático de escuela universitaria—university school professor), TEU (titular de escuela universitaria—university school holder), COL (colaborador—collaborator), AS (asociado—associate) and SI (sustituto interino—interim substitute).

	CU	TU	CD	AD	CEU	TEU	COL	AS	SI
Female	7	28	7	19	0	5	4	5	34
	3.17%	12.67%	3.17%	8.60%	0.00%	2.26%	1.81%	2.26%	15.38%
Male	18	31	9	17	1	7	6	4	19
	8.14%	14.03%	4.07%	7.69%	0.45%	3.17%	2.71%	1.81%	8.60%
Total per column	25	59	16	36	1	12	10	9	53
	11.31%	26.70%	7.24%	16.29%	0.45%	5.43%	4.52%	4.07%	23.98%

3. Results and Discussion

Following the consultation carried out, the results are collected in three blocks corresponding to: (1) the availability of tools for the adaptation to e-teaching; (2) the opinion on the teaching given and received, the time dedicated in this new teaching method and the differences that it presents compared to face-to-face teaching; and (3) concern regarding the evaluation of this teaching provided and the level of satisfaction with respect to the measures adopted and the new educational system.

3.1. Devices, Tools and Resources Available for Non-Face Teaching

When face-to-face teaching is suspended and given the immediacy of its need for adaptation to e-learning, the first block of questions is associated with the resources available for access to non-face-to-face teaching. In this same block, the preference of devices to be used in it and the professional and economic effort made by both students and university teachers for the transition from face-to-face teaching to e-teaching will be evaluated.

Students and teachers were asked about the quality of their Internet connection. The students scored their connection with an average of 6.82 ± 2.20 out of 10, while the teachers scored it with 7.76 ± 2.00. There is almost a point of difference between the two, where clearly the teachers have, in general, a better Internet connection than their students. We observed that the distribution of the scores does not follow a Normal distribution (Kolmogorov–Smirnov test not passed) so we used the non-parametric Mann–Whitney test to confirms these results. This contrast indicates that the median of the students' scores is higher than that of teachers with 95% confidence (p-value < 0.01).

Regarding the preferred devices with which e-learning is followed or taught, there are no major differences between teachers and students. Figure 2 shows that both students and teachers prefer the use of the laptop for their academic and teaching tasks (61% and 64%, respectively). The values that the use of the digital tablet receives are remarkably similar in both cases (10% and 8%). However, it is important to highlight the choice of mobile phone (19%) over desktop computer (10%) in the case of students, the latter (20%) being the second preferred option for teachers. These results indicate a certain preference of students to use mobile phones and tablets (29% of the total) versus teachers (16% of the total).

By means of a parametric contrast of difference of proportions, it is observed that there is insufficient statistical evidence to reject the null hypothesis that the proportions of laptop use are equal, so that a similar use is considered in both groups (p-value = 0.378) at 95% confidence.

It would be possible that these devices used in virtual teaching were not always available because they were shared by different members of the family unit or living group [45]. However, only 30.50% of students and 23.80% of teachers share devices, finding again more unfavourable values for students with almost seven points of difference.

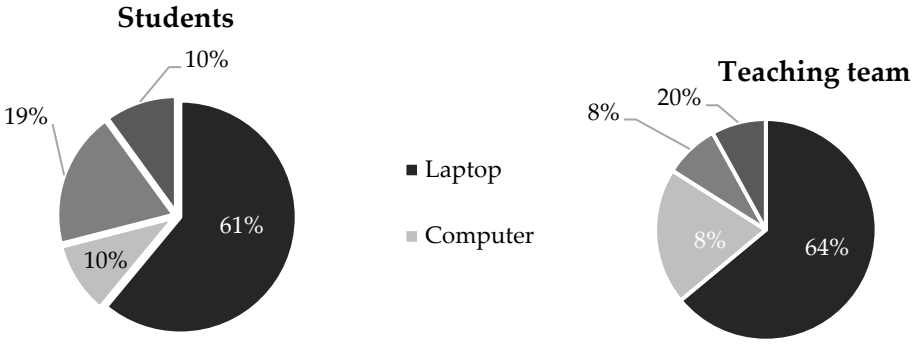

Figure 2. Devices used by students (**left**) and teachers (**right**).

However, the change from face-to-face to non-face-to-face teaching took place in a noticeably short time at the University of Cádiz (with the establishment of the state of alarm in March). This makes us wonder whether the devices available in the student or teacher's home allowed virtual teaching to be followed or given or whether it was necessary to acquire new devices to carry it out.

Surprisingly, students were prepared to follow non-face-to-face teaching with the resources at their disposal. Only 13% had to buy a device, while 25.10% of teachers had to buy new electronic devices to adapt to the new situation. This result indicates that more than a quarter of the teachers had to adapt their resources to be able to teach online (webcam, digital whiteboard, etc.) while the students were able to follow the lessons with

the computing devices available. The expense made by students and teachers in this section is reflected in Figure 3.

Figure 3. Expenditure on electronic devices by students (**left**) and teachers (**right**).

It is important to highlight that, although the percentage of students who had to make an investment is lower than that of teachers, it is observed that, among those who did so, more than half of the students spent more than €100, while the majority of teachers had lower expenses. It is noteworthy that among those who made some investment in tools to be able to teach or continue teaching, the average was higher for students (€239.71) than for teachers (€176.65). This may be related to the need to acquire computer equipment by students, the amount of which is higher.

Projecting these data on the totality of those consulted, there are not so many differences between the percentage of students and teachers who invested more than €100. In this case, the figures stand at 7.32% of students and 8.37% of teachers. Despite this change observed in the total figures, it is important to highlight that the teaching staff admit with a higher percentage the need to acquire devices for a lower amount, which is not so much the case with students.

Analysing this result in more detail, we observe that 22.79% of students have invested more than €500 compared to 18.33% of the teachers (3% versus 4.60% of teachers in total figures). On the other hand, 33.49% of students have invested between €100 and €500 (4.35% of the total number of students) compared to 15% of the teachers (3.77% of the total number of teachers) (Figure 3).

The following is the students' and teachers' perception of the tools commonly used in e-learning. For this purpose, the respondents rated, with a maximum score of five points, the valuation of the usefulness of these tools. The data are shown in Table 6.

Table 6. Usefulness of tools used for non-face-to-face teaching by students and teachers.

Average Profit	Notes or Presentations	Bibliography	Teacher's Videos	External Videos	Virtual Classrooms	Chat	E-mail	Forum
Students	2.99	1.67	2.88	2.31	2.76	2.22	2.82	1.94
Teaching team	4.05	3.19	3.44	2.95	3.69	3.12	4.11	3.39

We observe that the tools least valued by the students are the bibliography and the forum, followed by chats and videos external to the UCA, which are not useful either. For the teachers, the tool they consider the least useful is the external videos, followed by the chat and the bibliography.

The fact stands out that, on average, students do not rate the tools with a usefulness higher than three points, while for teaching staff, only external videos score slightly below three. This reveals serious differences that need to be reviewed, not only for online teaching but also for face-to-face teaching. This result indicates a change on the part of the new generations in their learning and knowledge acquisition preferences, which is not being considered by the teaching team.

The notes and/or presentations, together with the videos of their own teachers, lead the usefulness in the student sector. The teaching team also agrees that notes are one of the most useful utility. However, it is only surpassed by the item considered as the most useful—email. In [46], the study states that its usefulness is scored with 4.63 points out of 5 for the students. This value is higher than that obtained in our research (2.82).

In addition, questions were asked about other tools used to test telematics teaching. This information was subsequently categorized and grouped for better interpretation and analysis. The results are found in Table 7. We note as an outstanding fact that about 50% of those who added new tools emphasized the use of videoconferencing as the one that offered the greatest usefulness when imparting/receiving e-teaching (48.90% of students and 58.80% of teachers). These video calling options have been immensely popular as they have allowed greater contact and intercommunication between the teacher and the student. However, for example, in the previous study [46], a higher score (3.02) is shown for videoconferencing as online lessons. This is probably due to the fact that the teaching given during this period was not online, but an adaptation of face-to-face teaching to the digital media available.

Regarding this result, and as also stated in reference [17], we can conclude that students find e-learning easy to access and convenient for appropriate online lessons.

Table 7. Other tools used to monitor telematics teaching (percentage of total respondents).

	Students	Teaching Team
Videoconference	48.9	58.8
Tablet	13.3	1.8
Virtual classroom	8.9	1.8
Chat app	2.2	4.4
Online PDF notes	4.4	7.5

Finally, and studying the level of preparation teachers have for non-face-to-face teaching (Figure 4), the majority feel at least somewhat prepared (35%). Among those who are prepared to face e-teaching, only 7% do so at high levels, while 23% feel quite prepared, and only 22% prepared. For its part, the high percentage of 13% of teachers who do not feel prepared for face non-face-to-face teaching stands out.

Despite the fact that the majority of respondents, 87%, feel at least somewhat prepared, we observe that 57% of the teachers surveyed claim to have had to be trained after the onset of the pandemic to face adaptation to non-face-to-face teaching, compared to 43% who did not need it. In [47], 60% of the respondents had not used e-learning before the COVID-19 crisis; this result coincides with that obtained in our research.

With these numbers, it is worth noting that almost 50% of teachers (48%) are only somewhat or not at all prepared to deal with e-teaching, with more than half (57%) having needed additional training.

For example, other foreign governments started IT strategic plans to focus on making real changes in pedagogy and promoting e-learning [37]. Our results suggest that it seems to be necessary to invest in teacher training to improve their e-learning-related competencies.

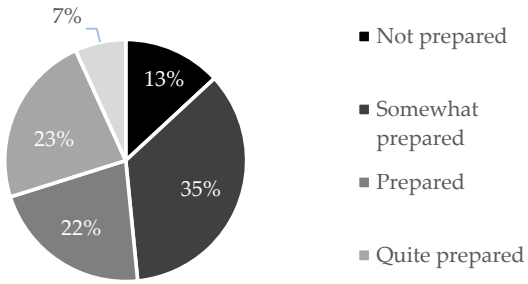

Figure 4. Level of preparation of teachers for non-face-to-face teaching.

3.2. E-Teaching vs. Face-to-Face Teaching. Valuation, Strengths, and Weakness

In this section, the methodology used by the teachers during the state of alarm was evaluated, as well as the acquisition of skills by the students and the preparation time of the subjects used by both teachers and students.

In the first case, a valuation was requested, out of 10 points, of the methodology developed for e-learning. We observed that, on average, the students at the University of Cádiz pass the methodology received with a 5.30 ± 2.10. This score increased to 7.90 ± 1.50 for the teachers valuing their methodology developed. The relative scores according to each profile are shown in Figure 5. Although the distribution of the scores in the students shows a relative symmetry around their mean value of 5.30, in the case of the teachers, there is a high bias to the left, indicating a greater concentration of high scores in this group. In other studies, such as [38,39], various scores of university students in e-learning have been observed. Their results are, in general, similar to those obtained by us.

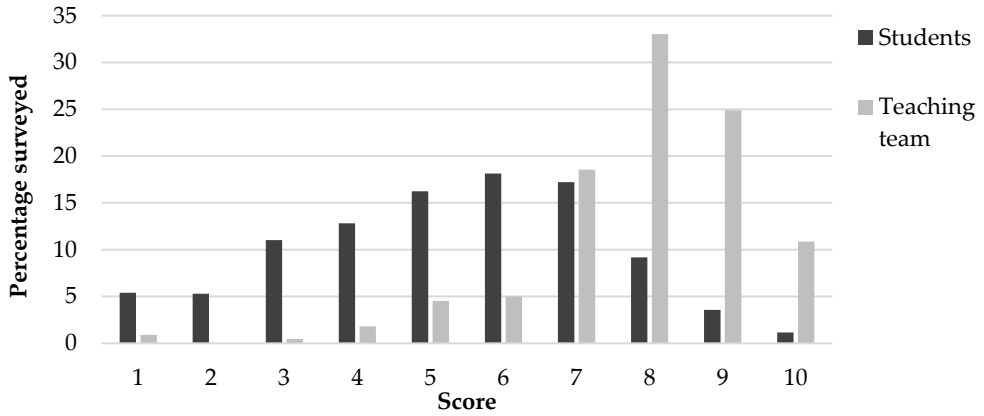

Figure 5. Methodology score percentages by students and teachers.

Distinguishing the methodology scores by areas of knowledge, as shown in Table 8, the data do not vary significantly. The average established by all the students would be 5.29 points out of 10, with hardly any differences between those from the different areas. Although the score is extremely low, the students would only fail with 4.65 points out of 10 for the methodology developed in arts and humanities.

The distribution of the scores does not meet the ANOVA requirements (normality not passed with a Kolmogorov–Smirnov test), so we applied a non-parametric Kruskal–Wallis test to compare the medians. We observed that, in the case of teachers, there are no statistically significant differences between the medians of the scores of the different areas at 95% confidence (p-value = 0.30 > 0.05). However, if this contrast is applied to the group of students, the differences in the medians are significant (p-value $\approx$ 0), highlighting the discrepancies in the scores in the areas of sciences and arts and humanities with the other areas.

The teachers' points of view have been more positive than those of the students in the transition to e-learning. However, it is confirmed that, for both groups, the level of acquisition of the competencies, knowledge and skills demanded by the labour market is akin to the face-to-face system. In Table 9, we break down the data obtained for each of them, indicating in bold the dominant opinion regarding the acquisition of each one, both by students and teachers. In red, we highlight the worst, the same and the best rated of each group.

Between the group of students, among the sixteen competencies, knowledge and/or skills studied, motivation and enthusiasm (1) stand out as the worst acquired in distance learning. Almost half of the teaching staff also negatively values their acquisition, so it is considered that non-face-to-face training presents difficulties in this area. This is very

worrying, being the most demanded competency by the labour market, and the most valued by recent graduates, who consider it essential to get a job [32].

Table 8. Methodology score by areas of knowledge according to students and teachers.

	Students			Teaching Team		
Knowledge Area	**Re-Count**	**Average**	**Standard Deviation**	**Re-Count**	**Average**	**Standard Deviation**
Arts and Humanities	298	4.65	2.22	35	7.66	1.59
Sciences	443	5.78	2.00	49	8.02	1.25
Social and Legal Sciences	985	5.26	2.07	67	7.91	1.68
Health Sciences	343	5.35	2.13	17	7.53	0.94
Engineering and Architecture	709	5.23	2.04	53	8.00	1.66

Table 9. Acquisition level of competences, knowledge, and skills. In red appears the worst, the same and the best rated of each group.

Nº	**Description**	**Students**			**Professors**		
		Worst	**Equal**	**Better**	**Worst**	**Equal**	**Better**
1	Motivation and enthusiasm	76.10%	17.24%	6.66%	47.96%	39.82%	12.22%
2	Quality orientation	73.25%	23.33%	3.42%	32.13%	60.63%	7.24%
3	Information search and management	40.71%	44.28%	15.01%	14.03%	58.82%	27.15%
4	Computing	24.66%	48.13%	27.21%	10.41%	34.39%	55.20%
5	Oral and written expression	41.00%	53.10%	5.90%	28.51%	62.90%	8.60%
6	Communication with students	42.40%	43.27%	14.33%	47.51%	37.56%	14.93%
7	Communication with teachers	55.62%	31.71%	12.67%	52.49%	31.22%	16.29%
8	Capacity for analysis and synthesis	44.71%	48.09%	7.20%	22.62%	63.35%	14.03%
9	Capacity to work under pressure	52.84%	32.15%	15.01%	30.77%	38.91%	30,32%
10	Organize and plan	48.88%	31.07%	20.05%	16.74%	47.06%	36.20%
11	Autonomy and decision making	31.39%	44.74%	23.87%	17.19%	54.75%	28.05%
12	Initiative, spirit and entrepreneurship	42.87%	41.72%	15.41%	20.81%	50.23%	28.96%
13	Creativity and innovation	42.15%	42.91%	14.94%	16.74%	39.37%	43.89%
14	Bargaining power	39.42%	50.43%	10.15%	19.00%	64.71%	16.29%
15	Leadership	37.87%	54.50%	7.63%	19.91%	69.23%	10.86%
16	Languages	32.00%	60.69%	7.31%	15.84%	76.92%	7.24%

For students, considering the orientation towards quality (2), we observed that this competence would be worsened with the adaptation to online teaching. However, most of the teachers think that there are no changes.

Likewise, communication between students (6) obtains the worst result according to teachers. More than half of them affirm that this skill has decreased. On the other hand, students are distributed equally between those who believe that communication with their classmates has decreased and those who believe that it has remained the same. They do not assume non-face-to-face teaching to be a benefit for communication between classmates. Communication between students and teachers (7) has been worse for both groups. About

half of the students and teachers think that communication between them has become more difficult.

These results are linked to those presented in [23], where the students saw as their biggest problems: lack of motivation, low interaction and understanding of the content. Likewise, we agree with the authors of [17] regarding the affirmation that it is important to improve the sustainable digital development in higher education. For these and other reasons, some researchers set that higher education institutions were not prepared for exclusively non-face-to-face learning [20].

The acquisition of computer skills (4) is the most improved in non-face-to-face mode for teachers. Although most students believe that their computer skills have remained the same, it is the best valued for its sector among all the others. This ability would be the most notable in this type of training system. In turn, non-face-to-face teaching would not enhance the improvement of this competence among students, assuming these levels as already acquired. This is probably due to a gap between the levels of computer knowledge between the teachers and the students, due to a generational effect.

Teachers and students have the same opinion in relation to the competencies and skills numbered 3, 5, 8, 11, 14, 15 and 16. Both groups agree that their acquisition is the same, whether it is face-to-face teaching or not. It is important to note that there is a greater consensus among students and teachers in general. The only exception is the ability to express themselves orally in writing (5), which students consider is acquired in a similar way in a higher percentage than teachers. It is important to note that 85% of the students believe that the search and information management competence has not been improved (3). That is a fact that concerns the students, when the autonomous work has increased, and computer tools should provide improvements for it.

The competence related to creativity and innovation (13) is one of the most improved for teachers, after computer skills. However, most of the students are divided between a worse and equal opinion in relation to this skill.

It is interesting to know how the workload of both groups varied between face-to-face and non-face-to-face teaching. These data are shown in Table 10. It is surprising to note that both the students and the teaching team spent an average of twelve hours a week to study and for class preparation, respectively. Even more remarkable is the fact that, for both groups, the number of hours of dedication has increased by approximately nine hours. Therefore, it can be stated that the switch to non-face-to-face teaching has led to a significant increase in the workload for both students and teachers.

Table 10. Weekly before–after preparation time by students and teachers.

	Students		**Teaching Team**	
	Before	**After**	**Before**	**After**
Average (hours)	11.99	20.99	11.94	20.87
Standard deviation (hours)	8.75	13.16	7.68	10.14

Performing a non-parametric Kruskal–Wallis test, we observe that there are no statistically significant differences between the median weekly time spent in classes between students and teachers in face-to-face teaching (p-value < 0.10) at 95% confidence. This result is similar in the case of comparing both groups in the time spent on virtual teaching. This indicates that the impact of the change in teaching paradigm has been similar in both groups, with an average increase of nine hours per week.

3.3. Satisfaction and Concern about Telematic Evaluation and Non-Face-to-Face Teaching

During the data collection period (April 2020), the high degree of ignorance on the part of students, including the teaching team themselves, about evaluation systems and methods, led to a high level of perceived concern. The results obtained indicate an average of 4.60 out of a maximum concern of 5 for the students and 4.10 points for the group of

teachers. On the other hand, in both cases, there is an extremely small deviation—0.84 in the case of students, and 1.10 in the case of teachers. These data indicate a remarkably high consensus both individually in both groups and as whole, although it is slightly higher in the case of students.

Students consider that the criteria for their evaluation are not defined in a conclusive 94% of cases, while teachers also do so clearly in 88% of those consulted.

Despite the high level of uncertainty expressed about the possibilities of developing a face-to-face or online evaluation, concern, and insecurity about a possible online evaluation is, once again, notably high for both audiences. In both cases, at least 7 out of 10 consulted consider that a virtual evaluation does not have sufficient guarantees for the correct qualification of students.

Both students and teachers also believe that the existing resources are, for the most part, not adequate for a guaranteed online evaluation. Their opinion is confronted with e-proctoring systems (remote monitoring systems), which ensure a similar situation in terms of face-to-face evaluation [40]. This is probably due to the fact that e-proctoring systems are not widespread in the university context [41].

In Figure 6, a relative consensus can again be observed between students and teachers with a greater concern, again on the part of the latter group, which indicates in 42% that the existing resources are not adequate for a correct evaluation, compared to 30.50% expressed by the students.

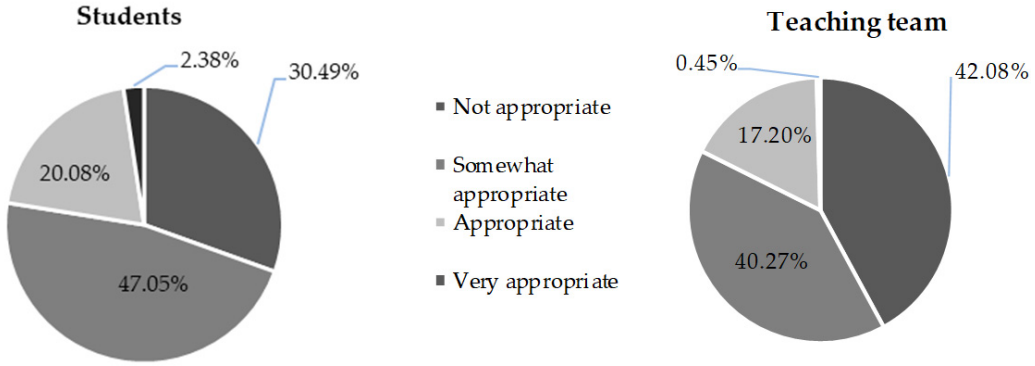

Figure 6. Availability of adequate resources for non-face-to-face evaluation.

Finally, an interesting result would be related to the perception of the difficulty of passing a subject using online resources. While 63% of teachers believe that an online assessment would make it easier, 83% of the students consulted believe that it would be more complicated (Figure 7).

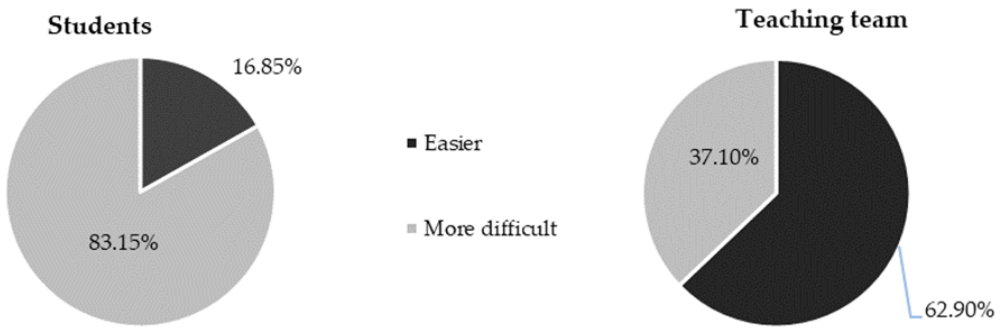

Figure 7. Difficulty of non-face-to-face evaluation compared to face-to-face evaluation.

In relation to the reasons given by each of the groups for indicating the perception of passing the subject when using distance methods, the responses were categorized for

a better analysis and, once grouped, the results are attached in Table 11. It is observed that a high percentage of students (42.20%) show concern about the assessment instruction used, an aspect that is also shared by teachers (15.60%). The students' mistrust of a poor adaptation of the subject (23.10%) and the difficulty of learning (17.70%) also stand out. The teachers, for their part, emphasise the perception that the distance methods make it possible to pass the subjects with less difficulty than in the face-to-face model.

Table 11. Respondents' perception of passing the subject when using distance methods (percentage with respect to total respondents).

	Students	Teaching Team
Learning difficulty	17.7	4.1
Worry about copying the exam	6.1	4.3
Concern about the Evaluation tool used	42.2	15.6
Bad adaptation of the subject	23.1	10.4
Greater difficulty than before	2.5	3.5
Similar difficulty as before	3.4	12.7
Less difficulty than before	7.5	17.9

In addition, this study not only questioned the level of student concern about distance evaluation, but also sought to assess the level of acceptance of non-face-to-face learning and its suitability for use in the 2019/2020 academic year (Figure 8). Clearly, the option of continuing classes in a non-face-to-face mode has been accepted as the most appropriate by both students and teachers. A total of 84% of students and 90% of teachers indicated this, compared to the remaining 16% and 10% who thought that face-to-face classes should have been postponed or cancelled to continue in the same modality. However, the majority of students think that it is not being developed adequately (65.84%) compared to a large percentage of teachers who think it is (58.82%). It is important to note that, despite this last data, 3 out of 10 teachers consulted are not satisfied with the teaching provided.

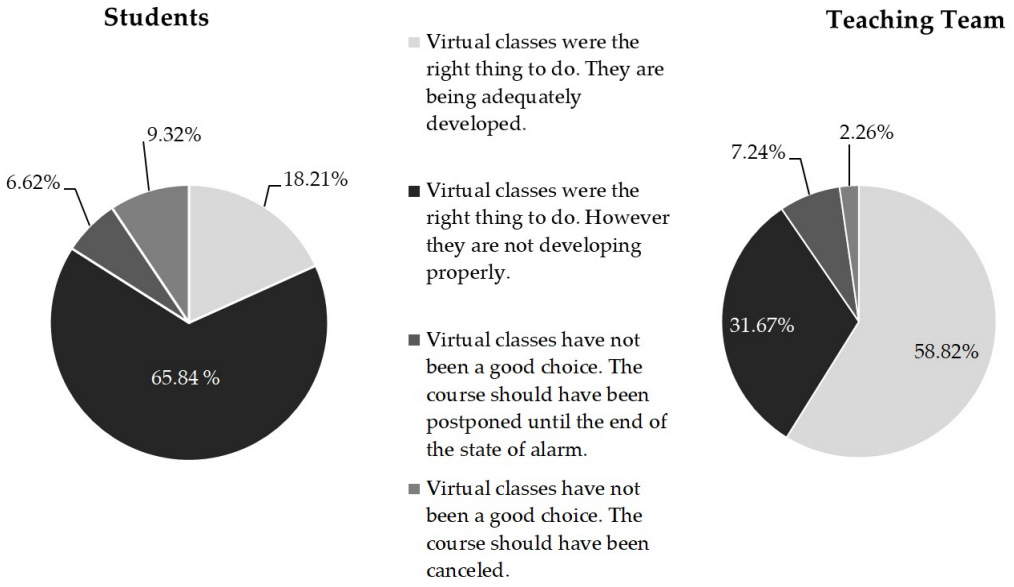

Figure 8. Satisfaction with the measures taken.

When asked about the possibility of continuing to teach some subjects in the future in a non-face-to-face mode, the teachers' response was clear, with 56.80% preferring face-to-face teaching compared to 43.20% who would be open to opening an online mode. This result shows the clear uncertainty of teachers about the transition to e-teaching. In the case of

students, the result is even more evident, with 67.10% of respondents showing no interest in continuing with the online mode.

The studies in [47,48] delve into the preference of a face-to-face or non-face-to-face modality under normal conditions. Thus, [47] evaluates the differences in students' performance and attitudes after receiving non-face-to-face teaching and face-to-face teaching through the design of an experience in which different students complete a course by both methods. The results of this study establish that non-face-to-face learning is preferred by students, who obtain equal or better results, demonstrating higher academic performance and motivation.

On the other hand, [48] establishes opposite results when analysing two equivalent postgraduate courses, which, during the same academic year, were developed, respectively, under face-to-face and non-face-to-face modalities. The results were very similar in both learning environments, although in this case, the preference was for face-to-face training. The discrepancy between the preference for an online and face-to-face mode fits with our approximate result of 50% in the choice of one mode over the other.

4. Conclusions

This work provides a particularly important initial insight into the early stages of the transition to e-teaching in April 2020. The results reflect an educational community with great uncertainty about the whole process, the future of the 2019/2020 academic year and the situation of the lockdown decreed in Spain in March 2020. This perception creates an unsustainable situation that is even more negative in the student community, which, at the time of the study, was excessively worried about the whole process of their university education.

Focusing on the objective set out at the beginning of the paper—the perceptions of students and teachers of emergency remote teaching with respect to the face-to-face model—we observed several differences.

With regard to the perception of the tools for adapting to the online mode, teachers consider that they have fewer resources at their disposal and that they lack the necessary training to carry out their teaching work adequately. In addition, students do not see so many deficiencies at this level.

On the other hand, considering the acquisition of competences and time commitment, we observed that both groups have a positive perception in relation to the ERT methodology, even though they have increased their workload. The lack of proximity in non-face-to-face learning is negative for competence acquisition.

Finally, in relation to the evaluation system and satisfaction with the measures taken, both groups agree that the tools available are not adequate for evaluation and disagree on the difficulty of evaluation. Despite the challenge of adapting ERT teaching, both groups consider that it has been the best option.

Specifically, a poor preparation of computer and Internet resources was observed, especially in the group of students (lower appreciation of the Internet, devices shared with other family members, and high-cost purchases). On the other hand, teachers had to update their material with lower-cost elements (digital whiteboards, webcam, etc.) in order to adapt their classes to this type of teaching. The digital gap between the two groups was a problem that universities tried to tackle in the first moments with various initiatives (laptop loans, internet vouchers, etc.)

A lack of training has also been revealed in almost half of the teachers surveyed, with 57% having received courses or seminars for better adaptation to improve e-teaching before lockdown. Indeed, our study highlights the need to improve e-teaching, not only in terms of methodology but also in terms of knowledge of the tools. For this purpose, the European Commission has launched the European Digital Education Action Plan (2021 to 2027) [49]. This action plan includes two strategies, the first one related to digital skills and competences and the second one concerning the adaptation of education and training systems to the digital age.

In relation to the methodology, it is clear that teachers have a more positive opinion of the quality of their teaching than students. On this point, students score 25% lower than teachers. In regular e-teaching courses, several researches state that the methodology scores for face-to-face learning and e-learning are similar [50–52]. Therefore, this low score of students may be related to the hurry in adapting to the new pandemic situation. Moreover, the lack of training in e-teaching with respect to face-to-face teaching probably also has an impact on this score, as we have already observed above.

On the other hand, both groups agree that motivation, enthusiasm and communication between students and teachers have suffered as a result of the paradigm shift to e-learning. As expected, computer literacy scores best in this transition.

A striking result is the increase in workload in both groups. Both students and teachers consider an increase of nine hours in class preparation and the study time with the change to e-learning. This result is also statistically significant and surprisingly similar in both classes.

In terms of evaluation, concern and uncertainty were clearly evident in the survey period. In addition, there is a lack of guarantees throughout the process (7 points out of 10) and a high percentage of respondents from both groups indicate that the resources were not adequate. Regarding the difficulty, in this case, students disagree with teachers, leaning toward the view that it will be more difficult to pass the subjects (83%) compared to 37% of teachers.

Based on these data, commitment to non-face-to-face learning is low at the time of the survey. A total of 43.2% of teachers would not mind adapting to e-learning, although only 32.9% of students prefer it. This may be due to the traumatic transition that the whole process of virtualisation entailed, pushed by a pandemic and a forced lockdown for months.

As a final conclusion, the data from this study reveal that ERT currently requires better methodologies and a greater number of tools to ensure quality education. University education managers are invited to provide solutions to the problems identified in order to make the transition from face-to-face to non-face-to-face training sustainable under conditions of sudden emergency. The main problems include general uncertainty in the transition, lack of communication, the implementation of a fair and adequate evaluation system and bridging the digital divide. All these problems have been highlighted in this study.

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